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ABSTRACT

This paper discusses a series of interdependent projects designed to further define the covert processes involved in utilizing cognitive skills, as well as the procedures necessary to train an individual in their use. In an early project designed to ascertain the types of strategies used by learners in an academic or training environment, participants received several learning tasks to perform. They were then asked to identify and explain the kinds of strategies used to learn these materials and to suggest other useful methods. Learning tasks included paired associates, serial lists, free recall lists, and reading comprehension. Data collected from this study were analyzed and combined with previous research results to produce the Learning Activities Questionnaire (LAQ), which has been extensively field tested and revised. Current results indicate that more successful learners, and those with more years of schooling, use meaningful elaboration strategies in preference to the more rote, or superficial, strategies. (Author/MV)

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Cognitive Elaboration Learning Strategies

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The theme of my presentation is the teaching or training of generalizable cognitive elaboration skills to improve learning. Many cognitive theorists are calling for the reinstatement of the individual learner in our conceptions of the learning act and the focusing of attention on the information processing capabilities that an individual brings to any learning or performance situation. Above all, most educators espouse humanistic goals of teaching students to "think for themselves" in order that they may function in an independent and creative manner in work contexts. And yet much educational practice and technology places the learner in an essentially passive role in which he or she is expected to learn simply because told to do so, to absorb information or skills automatically as a result of being exposed to the "right" teaching methods or curriculum.

A fundamental paradigm shift is taking place for both cognitive psychology and educational practice. Learning and educational psychologists have tended to view learning as the relatively automatic product of appropriate environmental or experimental circumstances which "condition" a new or learned response. Research and training efforts in both fields are moving away from

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a passive model of learning based on rather simple models of classical or instrumental "conditioning." They are moving towards, via what Dember (1974) calls the "cognitive revolution" in psychology, a model of the learner as an active, self-determining individual who processes information in complex, often idiosyncratic ways that can rarely be predicted entirely in advance, represented in simple formulae, or wholly captured in conventional laboratory learning experiments, and who learns through the active employment of complex learning or cognitive strategies that must be well in hand before he or she confronts a new learning task. Persons and learners are seen as always and essentially active interpreters, processors, synthesizers of a continual barrage of information from the outside environment and from their own thinking processes.

One way that learners can process to-be-learned information is through the use of cognitive elaboration. The use of elaboration as a cognitive strategy or skill implies that the learner uses a symbolic construction to add meaning to information he must learn (Rohwer, 1970). For example, in a paired-associate task this might involve forming an integrating mental image or sentence to associate the two members of a pair. When learning from text, the learner could relate the material to previous knowledge either directly or by analogy. Alternatively, elaboration could involve creating logical relationships within the material or the drawing of inferences, or implications. One explanation for the success of each of these procedures is that they make the new information more meaningful by forming a relationship between the new and familiar material and the old, already learned, information.

Studies by Borowski and Kamfonick (1972), Butterfield, Wambold, and Belmont (1973), Donner and Taylor (1973), MacMillan (1972), Rohwer and Ammon (1971), Ross (1971), Ross, Ross, and Downing (1973), Yuille and Catchpole (1973, 1974); and Dansereau, Long, McDonald, Actkinson, Ellis, Collins, Williams, and Evans (Note 1), suggest that subjects can be trained in the use of elaboration skills. Although this research has established the utility of mediational skills and the possibility of enriching an individual's repertoire through exposure or practice in their use, the studies of training effects have been limited in terms of the amount of practice time provided, the number of strategies taught, as well as the narrow definitions of the tasks and stimulus materials used. Highly similar content materials and tasks were employed for training as well as testing sessions. Thus, even when positive transfer effects have been demonstrated the data allow only limited generalizations of these findings both by the subjects and the experimenters. This restricts their utility in designing effective techniques to facilitate the development of mediational skills in deficient learners.

In addition, even in those studies in which the experimenters attempted to teach more than one type of strategy, the learners in any particular training group received instruction in the use of only one method. It is doubtful that any skilled learner relies on only one strategy to cope with the variety of learning tasks one must perform. An optimal training program for teaching learners to use generalizable cognitive skills would seem to require incorporating not only varied learning tasks and materials but also

a variety of cognitive strategies. In this way it is hoped that they will not learn particular strategies but will also learn to generate their own strategies.

A study by Weinstein (Note 2) was designed to investigate the effects of a diversified elaboration skill training program upon the learning and retention efficiency of ninth grade subjects. A variety of cognitive skills, learning task typologies and stimulus materials were selected to provide the learners with guided practice in the use of elaborative mediational skills. Unlike previous studies a variety of cognitive strategies including sentence elaboration, imaginal elaboration, analogies, drawing implications, creating relationships, and paraphrasing were included in the training. The learning tasks selected ranged from simple paired-associates and free recall to reading comprehension. Stimulus materials were drawn from ninth grade curriculum materials in science, history, English, foreign language, and vocational education.

Seventy-five ninth grade students were randomly assigned to one of three groups: training/experimental, control, or posttest only. Experimental subjects participated in a series of five 1-hour elaboration skill training sessions, administered at approximately 1-week intervals. Subjects were exposed to a set of 20 learning tasks. They were required to create a series of elaborators, or mediational aids, for each of these tasks. Experimenter provided directions for the early tasks emphasized the properties of an effective elaborator. The latter part of the training sessions provided additional practice for use of these skills with little

or no experimenter-provided instructions. The control subjects were exposed to the same stimulus materials but their task was simply to learn the information without any type of strategy prompts or directions. A posttest-only group was not exposed to the stimulus materials but did participate in the posttesting sessions. The immediate posttest was administered approximately one month later. Both immediate and delayed posttest consisted of a reading comprehension, free recall, paired-associate, and serial recall task.

The results of the data analyses for the immediate posttest revealed significant mean differences on the free recall and Trial 2 of the paired-associate learning tasks. In each instance the experimental group's performance surpassed the performance of the control and posttest-only, which did not significantly differ from each other. On the delayed posttest a significant difference was obtained for the reading comprehension task and Trial 1 of the serial learning task. Again these differences favored the experimental group. It seemed that students could learn to utilize these elaboration strategies in a variety of task situations but further research was still required to determine the optimal conditions for their learning and use.

Our current research and development effort involves a series of interdependent projects designed to further define the covert processes involved in utilizing cognitive skills as well as the procedures necessary to train an individual in their use. The ultimate goal is to design and field test a program to teach cognitive strategies to one or more of the

following target populations: high school students, college freshmen entering a university on a probationary status due to poor prior academic performance, or trainees in an armed services technical training setting. The typography of the final product will be a function of both the previous research by Weinstein (Note 2) and the data gathered during the course of the present research effort.

Successful learners utilize a variety of effective strategies to organize and execute any particular learning act. The typologies and essential components of these strategies have not, however, been systematically identified or classified. Previous research on the training of cognitive strategies has usually been based on laboratory studies of a single skill or on the experimenter's conjectures about what constitutes an effective cognitive strategy rather than on broad based evidence gathered from a large number of successful learners. Thus, one of our earliest projects was an exploratory study designed to ascertain the types of learning strategies used by learners in an academic or training environment.

Each subject participated in a 50-minute interview consisting of a series of semi-structured questions designed to guide but not restrict student responses. The participants received several learning tasks to perform and were then asked to identify and explain the kinds of methods, strategies, processes, or "mental tricks" he or she used to help learn these materials, and also to suggest any other strategies which might be useful. The learning tasks included paired-associates, serial lists, free recall lists, and reading comprehension.

The data collected from this study was carefully analyzed and then combined with the results of previous research to produce a learning strategies questionnaire. This instrument is designed to provide more specific information from a large number of subjects concerning their knowledge about learning strategies and how they use them. The questionnaire is divided up into two main sections. Part I presents seven learning activities, including three paired-associate word lists, two free recall word lists, and two reading passages. Each respondent is asked to answer a series of questions similar to the ones used in the interview study. For example (a) Describe one method or "mental trick" you would use to learn this material. (b) How did you learn to use this kind of method? (c) How old were you when you first learned to use this method? (d) In what way, or ways, do you think it helps you to learn? and (e) Do you use this method for other learning tasks? What kind of tasks? How often?

In Part II the respondents are asked to once again look at the seven learning activities but now they are presented with several lists of learning methods and asked to check the ones they would use to help themselves learn the material. For example, Table I, General Learning Methods and Examples for Activities One, Two, and Three, lists the various strategies one could use to learn a list of paired-associates. You will notice that the methods range from simple rote practice to meaningful elaboration, use of mental imagery, and of semantic relations. Table II, General Learning Methods and Examples for Activities Six and Seven, includes various strategies one

could use to learn from text. Again, the methods range from simple study skills to meaningful elaboration.

This instrument, called the Learning Activities Questionnaire (LAQ), has been extensively field tested and revised. It has already been administered to groups of community college, undergraduate, and graduate students, as well as several categories of Army recruits. We are in the process of administering it to high school students, junior college students in a vocational training program, and several other populations. The data derived from using this questionnaire is being used to identify promising variables for further research as well as to provide frequency of usage data for identified strategies across different learner populations.

Our results thus far indicate that more successful learners, and those with more years of schooling, use meaningful elaboration strategies in preference to the more rote, or superficial, strategies. For example, Army recruits with no high school experience, or a GED equivalency diploma, report using rote repetition as their major learning strategy, while second and third year undergraduate students report meaningful elaboration and other more active processing strategies. This finding can be related to the concepts of depth and spread of processing discussed by Craik and Lockhart (1972), Craik and Tulving (1975), and Moscovitch and Craik (1976).

Depth of processing refers to the degree of semantic or cognitive analysis the learner does with the to-be-learned material. Spread of encoding refers to the amount or different types of semantic processing which take place. It appears that elaboration learning strategies may

facilitate a learner's ability to process incoming information to a greater depth than might occur otherwise. In addition, meaningful elaboration can influence the spread of encoding. Our research also provides support for an even more recent refinement of this theory by Moscovitch and Craik (1976) indicating that the unity of encoding, or the formation of a congruent encoding, also facilitates recall.

An important question is whether the time and expenses involved in training is necessary, i.e., what are the relative merits of training and instructions as this relates to cognitive strategy acquisition. Previous research has not determined whether or not cognitive skill acquisition is predicated upon the practice and feedback involved in training and conducted over a temporal interval or whether simple exposure provided by instructions in the use of a particular strategy is sufficient for skill acquisition. The specific technique we selected for investigation was a classical mnemonic, or memory, technique called the method of loci.

The subjects in our study were randomly divided into five groups. Two groups received training in the use of the method of loci, two groups received only instructions in the use of the method of loci, and the fifth group, a control, did not receive any training or instruction on how to learn the material but did take the posttests. The results indicate that training is necessary if a memory skill, like using the method of loci, is to be truly effective. The instruction groups and the training groups did better than the control group but the training groups also did significantly better than the instruction groups. We are now attempting

to replicate these findings with elaboration strategies.

Our new elaboration strategies training program is also being used to investigate a number of other training variables including amount of practice, types of feedback, order of presentation for both the materials and the strategies, and methods of instructing the learner in the use of elaboration strategies.

The view of learning outlined in this presentation reduces the hope of finding curricula that will routinely and automatically produce effective learning in students or trainees. But it opens up the possibility of developing means to teach learners active cognitive self-management strategies which, if adopted, may enable them to learn well and perform creatively in almost any learning or training setting. Such means would place the learning and exercise of cognitive skills, a necessary ingredient of productive learning and creative performance, out of the reach of chance and place them under the systematic control of the individual learner.

TABLE I

General Learning Methods and Examples
for Activities One, Two and Three

NOTE: PLEASE CHECK THE EXAMPLES OF METHODS YOU WOULD USE TO LEARN ACTIVITIES ONE, TWO, OR THREE

Method 1. Practicing or Production

- ☐ A. Read the material over several times.
- ☐ B. Write the lists on another piece of paper.
- ☐ C. Test yourself on the material.
- ☐ D. Draw pictures or cartoons relating to the material.
- ☐ E. Learn the words in groups.

Method 2. Physical Word Similarities and Differences.

- ☐ A. Common patterns in spelling. For example, two words have a double letter.
- ☐ B. Similar or different letters.
- ☐ C. Similar or different sounds.
- ☐ D. Both have distinctive spellings or pronunciations.
- ☐ E. Comparing or contrasting the number of syllables or letters.

Method 3. Selecting a Part of the Words.

- ☐ A. Using abbreviations of the words.
- ☐ B. Using parts of each word to make a new word.
- ☐ C. Using only the first letter to remember the word.
- ☐ D. Acronyms - using the first letter of 2 or more words to make a new word or phrase.
- ☐ E. Alphabetize the words.

Method 4. Using "Pictures" in your Mind or Mental Imagery.

- ☐ A. Picture images or examples of both items in your mind side by side.
- ☐ B. Picture images or examples of both items doing something together.
- ☐ C. Picture images or examples of both items separately.
- ☐ D. Picture the actual printed word.
- ☐ E. Picture the words and "hear" yourself saying them.

Method 5. Meaningful Elaboration of the Material

NOTE: Please try to think of an example of how you would use this method. If you can't, it's OK. Check the Method anyway.

- ☐ A. Relate the words to your experience or your own attitudes.
Example:
- ☐ B. Relate the words to your beliefs or attitudes.
Example:
- ☐ C. Relate them to what you already know.
Example:
- ☐ D. Try to find logical relations between the items.
Example:

- ____ E. Imagine or picture a situation or event that relates the items.
Example:
- ____ F. Think of the implications, or effects, of pairing the items.
Example:

Method 6. Find Meaningful Similarities and Differences.

- A. Think about the similarities and differences between the meanings of the words.
- B. Find a word or make up a word that will connect, or associate the two items in a pair.

Method 7. Make up Phrases or Sentences

- ____ A. Make up a phrase or sentence using both members of a pair.
- ____ B. Make up a phrase or sentence relating both members of a pair.
- ____ C. Make up phrases or sentences using words whose first letter is the same as the words on the list.
- ____ D. Make up a rhyme using the words.
- ____ E. Make up a paragraph or a story using word pairs from the list.

Method 8. Categorize the Words on the List.

- ____ A. Pick out happy and sad words or positive and negative words.
- ____ B. Divide the words by type, class or category, such as animal, vegetable, or mineral; type of material they are made from and so on.
- ____ C. Divide the words by the uses they have.
- ____ D. Pick out the easy and hard words.

Other: Please write down any other methods or comments you have. Also write down any combinations you make of two or more methods.
(Feel free to use the back of this page if you need more room.)

General Learning Methods and Examples
For Activities Six and Seven

NOTE: CHECK ANY EXAMPLES OF METHODS YOU WOULD USE TO LEARN THESE MATERIALS.
PLEASE READ THE LIST CAREFULLY BECAUSE SOME OF THE METHODS AND THE
EXAMPLES ARE DIFFERENT FROM THE ONES YOU SAW FOR THE OTHER ACTIVITIES.

Method 1. Using Study Skills, Practice or Production

- _____ A. Read the material over several times.
- _____ B. Underline key ideas or words.
- _____ C. Take notes.
- _____ D. Summarize the material.
- _____ E. Summarize by paragraph or section
- _____ F. List major words or ideas.
- _____ G. Rewrite it.
- _____ H. Paraphrase, that is, write the information and ideas in your own words.
- _____ I. Review to check your understanding.
- _____ J. Ask yourself questions.
- _____ K. Draw pictures or cartoons relating to the material.
- _____ L. Create an outline.

Method 2. Selecting Parts of the Reading

- _____ A. Select out the main ideas.
- _____ B. Select out the key words or terms.
- _____ C. Select out the action phrases.
- _____ D. Select out the characters.

Method 3. Using "Pictures" in your Mind or Mental Images

- _____ A. Picture the main ideas or information
- _____ B. Picture examples.
- _____ C. Picture a story.
- _____ D. "See" and "hear" the events in your mind.

Method 4. Meaningful Elaboration of the Material.

NOTE: Please try to think of an example of how you would use this method. If you can't, it's OK. Check the Method anyway.

- _____ A. Think about the purpose or need for the material.
Example:
- _____ B. Relate it to your experience or characteristics.
Example:
- _____ C. Relate it to your beliefs or attitudes.
Example:
- _____ D. Think about your emotional reactions to the content.
Example:
- _____ E. Relate it to people in general.
Example:
- _____ F. Think about the ideas that you have as you read it.
Example:
- _____ G. Think about other people's reactions to the content or ideas.
Example:
- _____ H. Relate it to what you already know.
Example:
- _____ I. "Free associate" to the topic or ideas, that is, just think about the topic or ideas and see what comes to your mind.
Example:
- _____ J. Think about the implications, or effect, of what the material is saying.
Example:
- _____ K. Look for common sense or logical relationships in the material.
Example:
- _____ L. Relate the content to the theme.
Example:
- _____ M. Relate key words or concepts to ideas.
Example:
- _____ N. Discussion with other people.

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